

CLAIMS

1. A method for preventing vehicle rollover for a vehicle traveling on a road, said method comprising:

for each present position of said vehicle as it travels on said road, 5 forecasting future speed of said vehicle as a function of future position of said vehicle on said road, based on an assumption regarding a driving style of a driver of said vehicle, and based on a map containing road geometry data and statistical speed data for vehicles traveling said road;

10 at each said present position of said vehicle, determining a maximum safe speed of said vehicle for each of a plurality of points on said road forward of said vehicle, based on a maximum lateral acceleration, on said road geometry and on physical parameters of said vehicle; and

15 generating a rollover warning for any current position of said vehicle on said road at which the forecast future speed for at least one particular point on said road forward of said vehicle exceeds the determined maximum safe speed at said at least one particular point.

2. The method according to claim 1, wherein said maximum safe speed is a speed beyond which, based on said road geometry and on said parameters of said vehicle, it is unavoidable that the vehicle will subsequently encounter a 20 lateral acceleration that will cause it to roll over.

3. The method according to claim 1, wherein said vehicle speed is forecasted based on a model of driving behavior derived from data contained in said map data.

4. The method according to claim 3, wherein the future vehicle speed 25 is forecasted based on an assumption that the driver of the vehicle will maintain the same percentile position relative to speed data contained in said map, throughout the road forward of said vehicle.

5. The method according to claim 3, wherein said model of driving behavior assumes that the vehicle will maintain a constant speed.

6. The method according to claim 3, wherein said model assumes that the vehicle will maintain a constant acceleration.

5 7. The method according to claim 3, wherein said model forecasts speed of said vehicle as a median speed for each point on said road, based on vehicle speed data contained in said map.

10 8. The method according to claim 2, wherein said maximum safe speed is determined based on curvature of said road at each of said points on said road forward of said present position.

9. The method according to claim 2, wherein said maximum safe speed is determined by a cost function that takes into account at least longitudinal speed and lateral acceleration of said vehicle.

10 10. The method according to claim 9, wherein said cost function further 15 takes into account fuel consumption of said vehicle.

20 11. The method according to claim 1, wherein when said forecasted future speed of said vehicle at a particular point on said road forward of said vehicle exceeds the maximum safe speed determined for that particular point, remedial action is taken at a point in time which is determined as a function of at least one of driver reaction time, maximum vehicle deceleration, a minimum time to achieve said maximum vehicle deceleration and a speed cushion.

12. The method according to claim 11, wherein:

said remedial action comprises a warning to said driver; and

25 said warning is given at a point in time such that, after the reaction time, the maximum deceleration will bring the vehicle to the speed cushion below the maximum safe speed at a time t corresponding to particular point.

13. The method according to claim 11, wherein said remedial action includes an automatic slowing of the vehicle.

14. The method according to claim 1, wherein said statistical speed data contained in said map comprises speed data collected from actual truck operations over roads contained in said map, using GPS data to determine points along said road.

5 15. The method according to claim 14, wherein said map includes data characterizing at least one of vehicle position GPS, GPS error estimates, vehicle speed, measured lateral acceleration, vehicle operating parameters and lane-tracker information.

16. The method according to claim 15 wherein:

10 GPS points are map matched with a commercially available digital map;

a GPS trace is broken into map segments based on said map;

all GPS traces on each segment are collected;

B-splines are fit to said traces to determine a centerline of the road;

15 curvature along each segment is determined based on a derivative of said splines.

17. The method according to claim 1, wherein said future speed of said vehicle and said maximum safe speed are dynamically computed at each present position of said vehicle as it moves over said road, based on road geometry for 20 said road forward of said particular position.